Preliminary ODH Calculations for the MINOS Near Detector Hall if it housed the NOvA near detector and the NOvA near detector was housed in an inert gas at standard conditions for fire protection reasons.

NOvA Near Detector Inert Volume Dimensions:

Length	75.000	meters	246.03	feet
Width	4.000	meters	13.1216	feet
Height	4.000	meters	13.1216	feet
Volume	1200.000	meters^3	42,361	feet^3

Minos Near Detector Hall Dimensions:

Length	45.726	meters	150	feet
Width	9.450	meters	31	feet
Height	9.755	meters	32	feet
Volume	4215.242	meters^3	148,800	feet^3

Minos Near Detector Access Tunnel Enlargement Dimensions:

Length	27.436	meters	90	feet
Width	6.706	meters	22	feet
Height	7.926	meters	26	feet
Volume	1458.338	meters^3	51,480	feet^3

Minos Near Detector Access Tunnel Dimensions:

Length	48.775	meters	160	feet
Width	6.402	meters	21	feet
Height	6.402	meters	21	feet
Volume	1998.841	meters^3	70,560	feet^3

Sum of the Volume from the shaft to the end of the MINOS near detector hall:

Volume	7672.420	meters^3	270,840	feet^3

Sum of the Volume of the NOvA near detector proposed inert atmosphere:

Volume	1200.000	meters^3	42,361	feet^3

Sum of the Volume from the shaft to the end of the MINOS near detector hall less the volume of the NOvA inert atmosphere:

Volume	6472.420	meters^3	228,479	feet^3

Concentration of oxygen in the MINOS near Detector Hall and access shafts:

% O2	21.000	%

Concentration of oxygen in the inert atmosphere:

% O2	0.000	%

% O2 if the two volumns instantanously mix:
% O2 17.716 %

Since 17.7% is less than 18%, an ODH condition would exist if the volume instaneously mixed with the near detector hall air. But this is an extreme condition, unable to happen. So, assume a finite time of two hours to ventilate this inert atmosphere enclosure an mix this inert atmosphere with the hall air. Assume hall ventillation rate as shown on the Outfitting drawing package of 4000 cfm minimum.

Time to purge the NOvA Near Detector Inert Atmosphere into the hall:
Time 120.000 minutes
Rate 353.005 cfm 350 cfm is a pretty rapid ventillation rate and requires forced ventillation.
For time of zero to: 120.00 minutes purging inert volume

$$f_{O2}(t) = \frac{0.21}{Q+R} \cdot (Q + R \cdot \exp(-\frac{(Q+R)}{V} \cdot t)) \cdot 100\%$$

For time of 120 minutes to infinity: recovering O2

$$f_{02}(t) = {}^{V}/_{Q} * (0.21 * {}^{Q}/_{V} - C\, e^{-(Q/vol * t)}$$

where C is (0.21*Q/Vol)-(initial O2 concentration at the end of the purge* Q/Vol)

Vent rate	Spill Rate	Volume
Q, cfm	R, cfm	V, cf
4000	353.005	6,472

MINOS Near Detector Hall Oxygen Concentration as a function of time

t, min	C, %
0	21.0000
1	20.1662
2	19.7407
3	19.5235
4	19.4126
5	19.3560
6	19.3271
7	19.3124
8	19.3049
9	19.3010
10	19.2991
11	19.2981
12	19.2975
13	19.2973
14	19.2972
15	19.2971
16	19.2971
17	19.2970
18	19.2970

19	19.2970
20	19.2970
30	19.2970
40	19.2970
50	19.2970
60	19.2970
70	19.2970
80	19.2970
90	19.2970
100	19.2970
110	19.2970
120	19.2970
121	20.0821
123	20.5052
126	20.7333
130	20.8562
135	20.9225
141	20.9582
148	20.9775
156	20.9879
165	20.9935
175	20.9965
186	20.9981

at this point in time, the inert atmosphere is purged.